

REMARKS

Claims 1-34 remain in the case.

The present invention relates in general to modular regenerative braking system. The present invention has the advantage of reducing the number of three-way proportional valves and pressure sensors required to sense pressure at each proportional valve which reduces the cost and complexity of the modular braking unit. Furthermore, because of the reduction of the number of electrical devices used in the modular braking unit, less energy will be required to maintain operation of the electrical devices which is extremely advantageous when using regenerative braking. Moreover, the above modular braking unit is compatible with regenerative braking and low cost conventional modular slip control HCU's.

The rejection of claims 1-4, and 8 under 35 U.S.C. 102(b) as being unpatentable by Campau et. al. '608 is respectfully traversed.

Independent claim 1 recites a modular braking unit having a first, second, and third circuit of pressurized brake fluid. A first fluid separator unit is coupled between the first and second brake circuit and a second fluid separator unit is coupled between the first and third brake circuit. A proportional valve selectively controls the pressure of the hydraulic brake fluid within the first circuit. The pressure within the first circuit acts on both the first and second separator units which enables the pressurized brake fluid in the second and third brake circuits to act on a first set and a second set of brake actuators.

Campau neither shows nor suggests a proportional valve acting on a pair of separation units for applying pressurized brake fluid to a first and second set of brake actuators. Campau shows four three-way proportional valves each controlling the pressure exerted on a respective vehicle brake. In a first embodiment of Campau, a first and second separator unit are disposed between a first and second three-way proportional valve, and a first and a second vehicle brake, respectively. The third and fourth vehicle brakes are controlled directly by the third and fourth three-way proportional valves, respectively, without the use of a separator valve. In another embodiment of Campau, a respective separator valve is disposed between each three-

way proportional valve and each vehicle brake. This embodiment fails to show or suggest how a proportional valve in cooperation with two separator units can control the pressurized brake fluid to all four vehicle brakes. Moreover, Campau fails to show or suggest how four proportional valves in cooperation with two separator units can control the flow of pressurized brake fluid to all four vehicle brakes. Therefore claim 1 is allowable.

Claims 2-4, and 8 all ultimately depend from claim 1 and are also allowable over the cited art for at least the same reasons as claim 1.

Moreover, claim 3 recites four proportional valves where a first and second proportional valve act on a first and second separator unit to actuate all four vehicle brakes and a third and fourth proportional valve to relieve pressure from said first and second separator units for relieving pressurized brake fluid from each of the vehicle brakes. Campau neither shows nor suggests the use of two proportional valves to act on a pair of separator units for controlling pressurized brake fluid to all four vehicle brakes nor two additional proportional valves to relieve pressure from the pair of separator units for relieving pressure from all four vehicle brakes.

The rejection of claim 5-7 under 35 U.S.C. 103(a) as being unpatentable over Campau in view of Ganzel '484 or Jonner is respectfully traversed.

Claim 5 and claim 6 recite the use of two two-way proportional valves for providing pressurized brake fluid to the pair of isolation valves and two two-way proportional valves for relieving pressure from the pair of separation units. Campau shows the use of a plurality of three-way proportional valves which are more costly and complex than two-way proportional valves. Furthermore, neither the three-way proportional valves are used in cooperation with the pair of separation units for applying pressure to all four vehicle brakes or for relieving pressure from all four vehicle brakes. Ganzel '484 uses a three-way proportional valve which supplies pressurized brake fluid to four two-way proportional valves (one two-way valve on each vehicle brake circuit) which in-turn supplies pressurized brake fluid to each vehicle brake. Jonner shows four two-way proportional valves for supplying pressurized brake fluid directly to each vehicle brake, respectively, and four additional two-way proportional valves for relieving pressurized brake fluid from each vehicle brake, respectively. The references cited fail to show or suggest either individually or

in combination the use of the two-way proportional valves in cooperation with the pair of separation units for supplying and relieving pressurized brake fluid from the vehicle brakes. Therefore, claims 5 and 6 are allowable.

Claim 7 recites the use of a compliance accumulator to compensate for pressure errors caused by improperly timed valve actuations between the brake module and a secondary braking module (e.g., ABS) which results in excessive or inadequate pressure in the first, second, or third circuits. Neither of the references either individually or in combination teach or suggest the use of a compliance accumulator to alleviate pressure errors between a first braking module and a secondary braking module. Therefore, claim 7 is allowable.

The rejection of claim 9-12, 14-24, 26-28, 30-34 under 35 U.S.C. 103(a) as being unpatentable over Campau in view of Arwine or Tanaka or Ganzel '582 is respectfully traversed.

Claims 9 and 31 recite a braking system utilizing the same elements of the brake module as set forth in claim 1 in cooperation with a second brake module. The cited references either individually or in combination fail to show or suggest a second brake module in cooperation with elements of the brake module as claimed. Therefore, claims 9 and 31 are allowable.

Claim 10-12 depend from claim 9 and each recite a specific second braking module such as an anti-lock brake module, traction control module, and a vehicle stability control module which are utilized in cooperation with the braking module elements of claim 9. Since the cited references either individually or in combination fail to show each specific second brake module, or any general second brake module for that matter, in cooperation with elements of the brake module as claimed, claims 10-12 are allowable.

Claim 14-18 depend from claim 9 and for at least the reasons discussed earlier regarding the allowability of claim 9, claim 14-18 are therefore allowable.

Claims 19-30 recite a relief valve, isolation valve, dump valve, and low pressure accumulator used individually or in combination with one another within a second brake module for relieving an over-pressurization within a vehicle brake. None of the references suggest or teach the various valves within a second brake module for relieving over-pressurization. Since the references either individually or in

combination fail to show the various valve configuration within the second brake module, and for at least the reasons discussed earlier regarding the allowability of claim 9, claims 19-30 are therefore allowable.

The rejection of claim 13, 25, and 29 under 35 U.S.C. 103(a) as being unpatentable over Campau in view of Arwine or Tanaka or Ganzel '582 in view of Ganzel '484 is respectfully traversed.

Claim 13 recites the use of a single three-way proportional valve. The office action states that using one three-way proportional valve as taught by Ganzel '484 instead of the four shown by Campau would have been obvious. Ganzel '484 uses one three-way proportional valve in addition to a plurality of apply and dump valves to deliver and relieve braking fluid to each respective vehicle brake. The present invention uses only one three-way proportional valve without the use of any additional apply or dump valves to provide and relieve pressurized brake fluid to and from each vehicle brake. The addition of Campau does not assist in teaching or suggesting the invention since Campau uses four three-way proportional valves with the use of four separation valves for applying braking fluid to the respective vehicle brakes. The present invention uses only one three-way proportional valve and two separator units for actuating all vehicle brakes. Since both Campau or Ganzel '484 individually or in combination fail to teach or show the present invention, claim 13 is allowable.

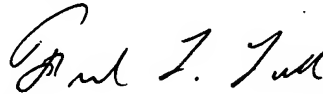
Claims 25 and 29 each recite a second brake module including a dump valve and a low pressure accumulator configured to divert brake fluid pressure to the low pressure accumulator. None of the references teach or suggest the various valve configurations within a second brake module for relieving over-pressurization. Therefore, claims 25 and 29 are allowable.

The office action states that many of the valves are known in the art and it would be obvious to substitute such valves to achieve the functions of the present invention. Even though the recited valves used in the present invention are individually known in the art, the invention achieves a novel and nonobvious combination and configuration of the valves resulting in a previously unknown reduction in the complexity and cost of a braking system. If such configurations had been obvious, then these improvements would have been utilized in the art. Furthermore, by reducing the number of valves and replacing the complex valves with

less complex valves as recited in the present invention, less energy is required for maintaining operation of such devices which is beneficial especially when utilizing regenerative braking.

In view of the foregoing amendment and remarks, all pending claims are in condition for allowance. Favorable action is respectfully solicited.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Frank L. Lollo", is positioned above a horizontal line.

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